Landsat Science Team

Landsat Advisory Group Status Report

Kass Green

July, 2016

Overview

I. LAG Purpose and Functions
II. LAG 2015 and 2016 membership
III. LAG 2015 tasks and reports
    A. Non Federal Users Requirements Study
    B. Sentinel and Smallsat Study
IV. LAG 2016 tasks

I. LAG Purpose

Provide advice to the Federal Government, through the Department of the Interior National Geospatial Advisory Committee, on the requirements, objectives and actions of the Landsat Program as they apply to continued delivery of societal benefits for the Nation and the global Earth observation community.

I. LAG Functions

The LAG develops advice and recommendations on Landsat-related issues for consideration by the NGAC, including the following:

- Operational and scientific Landsat Program requirements.
- U.S. policies relevant to the Landsat Program, consistent with the economic, scientific, environmental, security, and foreign policy interests of the United States.
- Landsat imagery, data and information availability for all public, private and international purposes, including the means and methods of information access and distribution.
- The National Satellite Land Remote Sensing Data Archive as the primary U.S. Landsat data repository.
- Future Landsat Program plans and efforts in coordination with the National Earth Observations (NEO) Task Force, etc.
- Priorities and communication of the Landsat Program.

II. LAG 2015 Membership

Name	Organization
Jack Hild (LAG Chair, NGAC Member)	Hild Enterprises, LLC
Kass Green (LAG Co-Chair, past NGAC Member)	Kass Green & Associates
Roger Mitchell (LAG Co-Chair, NGAC Member)	MDA Information Systems, Inc.
Peter Becker	ESRI
John Copple	Sanborn Map Co.
Joanne Gabrynowicz (NGAC Member)	University of Mississippi
Kevin Hope	National Geospatial-Intelligence Agency
Roberta Lenczowski	AmericaView
Rebecca Moore	Google, Inc.
Cory Springer	Ball Aerospace & Technologies Corp.
Julie Sweetkind-Singer (NGAC Member)	Stanford University
Tony Willardson	Western States Water Council
Darrel Williams	Global Science & Technology, Inc.

Federal Contact: Tim Newman (USGS)

II. LAG 2016 Membership

Name	Organization
Joanne Gabrynowicz (NGAC Member, Chair)	University of Mississippi
Frank Avila (NGAC member, Vice Chair)*	National Geospatial-Intelligence Agency
Roger Mitchell (NGAC member)	MDA Information Systems, Inc.
Rebecca Moore (NGAC member)	Google, Inc.
Kass Green (former NGAC member)	Kass Green & Associates
Walter Scott*	Digital Globe
Roberta Lenczowski	AmericaView
Peter Becker	Esri
Jed Sundwall*	Amazon Web Services
Tony Willardson	Western States Water Council
Steven Brumby*	Descartes Labs

* new members

Former LAG member Julie Sweetkind-Singer of Stanford University is now the Chair of NGAC
Federal Contact: Tim Newman (USGS)

III. 2015 LAG Tasks and Reports

Tasks

1. USGS Land Remote Sensing Program (LRSP); provide suggestions for non-Federal data requirements
2. Regarding Sentinel and new commercial smallsats and microsats: identify success non-Federal users are having with data access and delivery mechanisms, data-use policies, and data applications.
3. Follow-up activities to 2013 LAG cloud and product papers and recommendations.

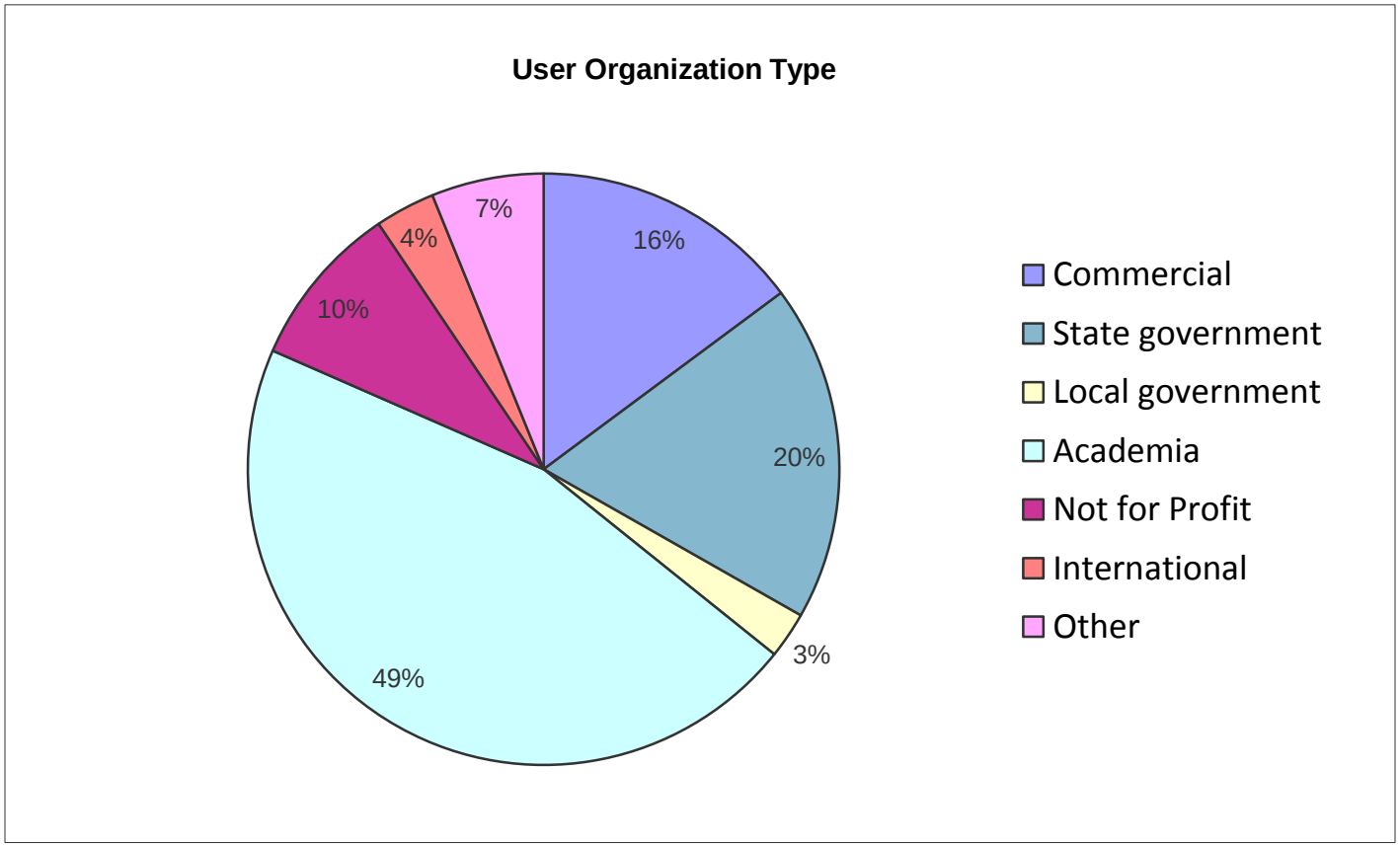
III. 2015 Tasks and Reports

- Landsat non federal requirements report
  - http://www.fgdc.gov/ngac/meetings/april-2016/landsat-user-requirements-analysis-ngac-june-2016.pdf
- Sentinel – small sat report
  - http://www.fgdc.gov/ngac/meetings/december-2015/ngac-paper-sentinel-data-use-policies.pdf

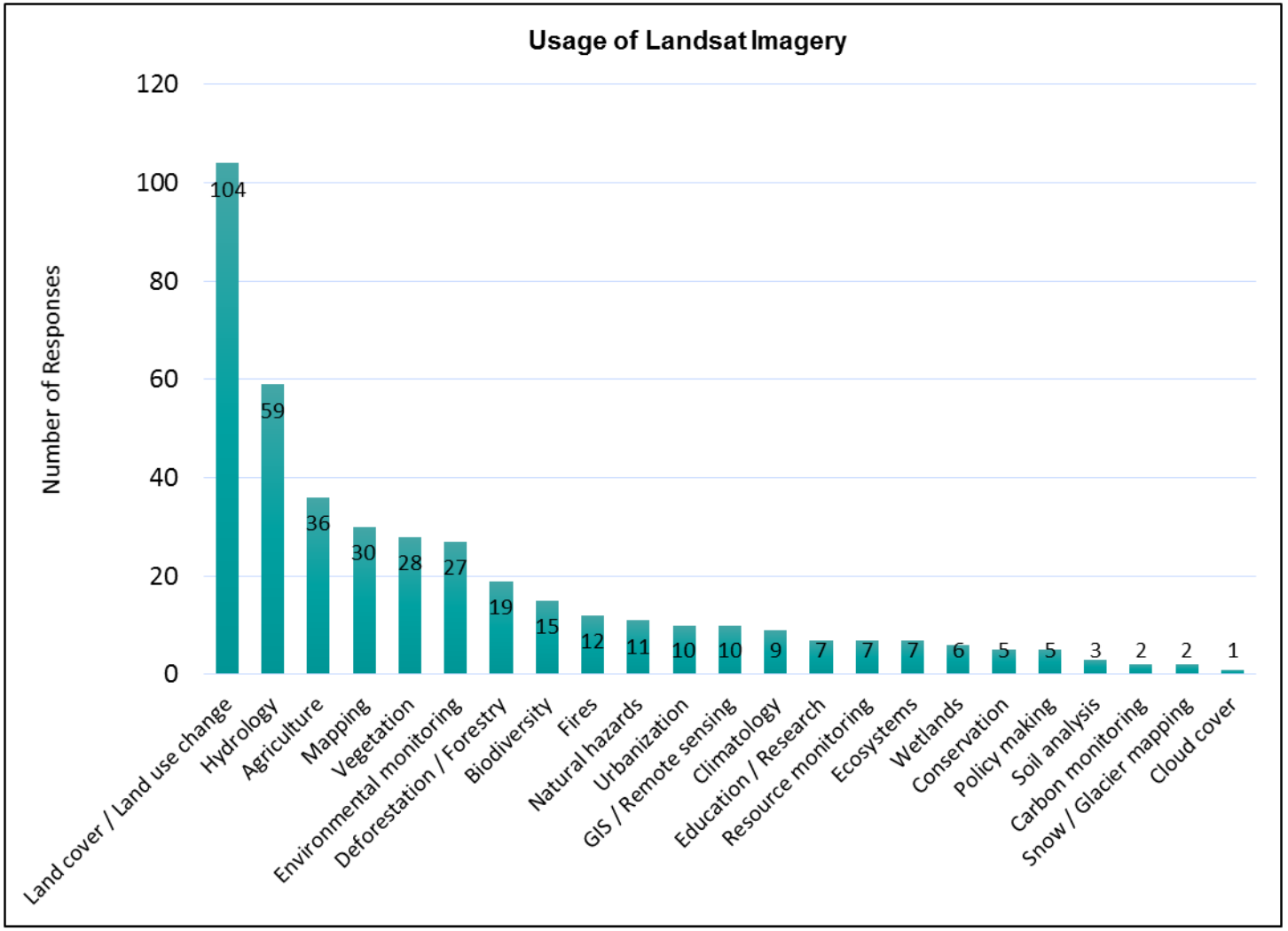
A. Non-Federal Landsat Requirements Report

- Method – Short 9 question SurveyMonkey questionnaire circulated among colleagues and announced at major conferences including LST, Esri, Google Earth Engine, etc. Thanks to LST members for participating and promoting the questionnaire.
- 285 participants, but few responded to all the questions.

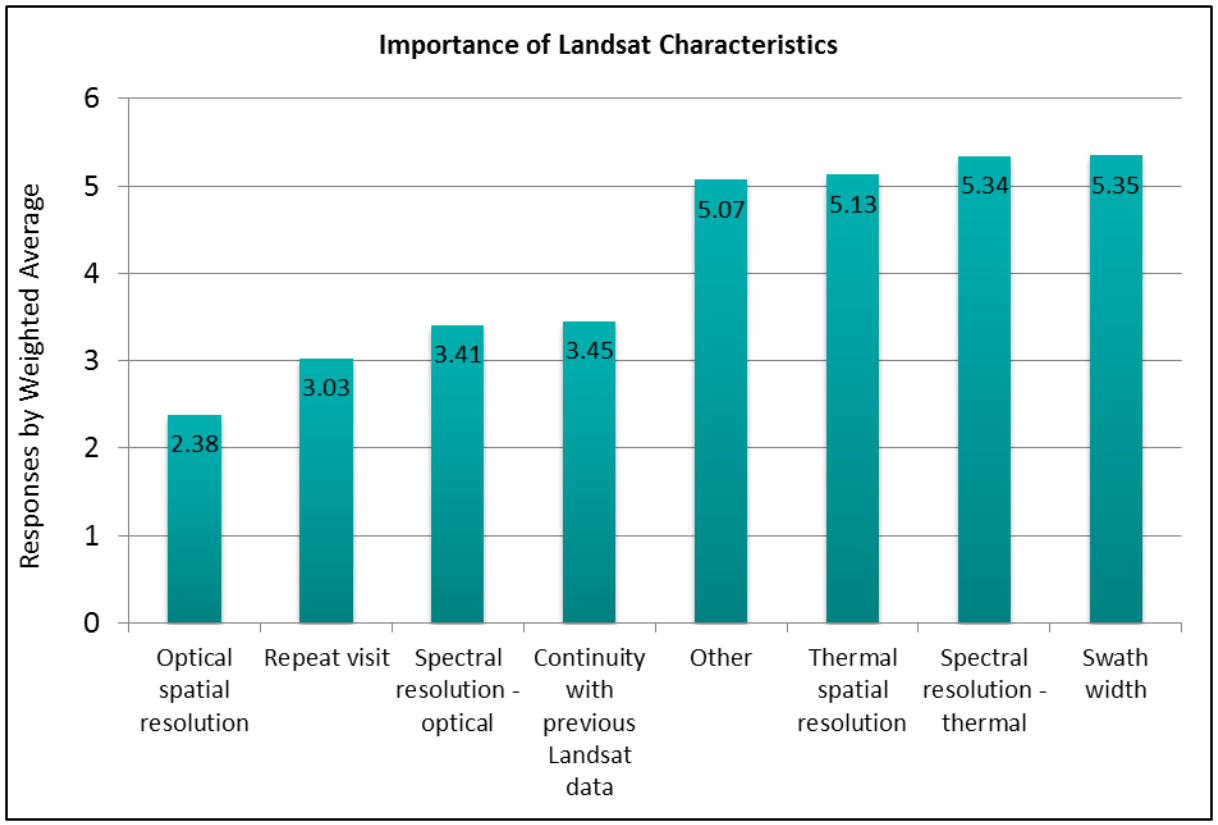
Respondent Organization Type



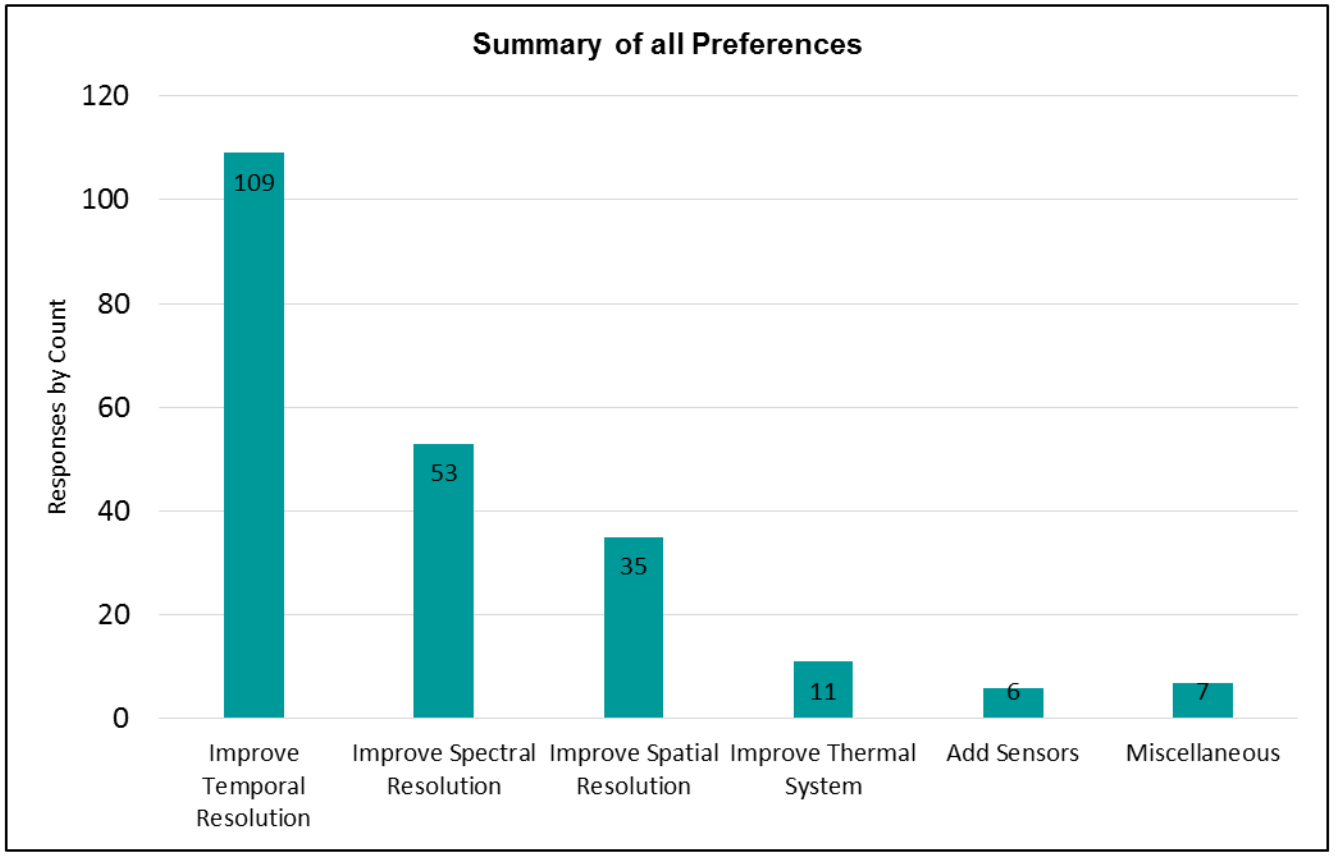
Use of Landsat Imagery



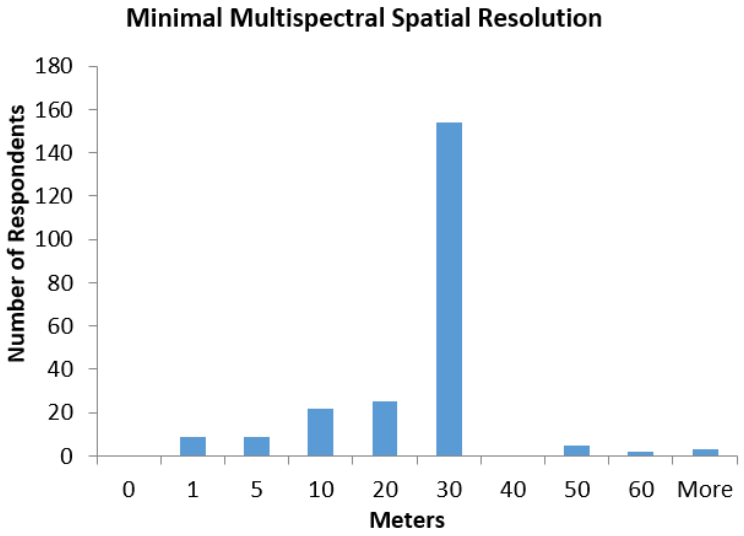
Importance of Landsat Characteristics

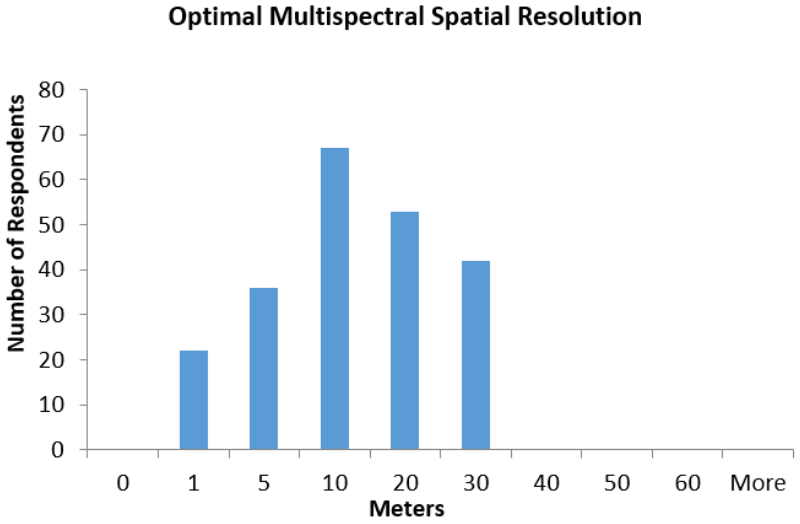


What Should be Added to Landsat?

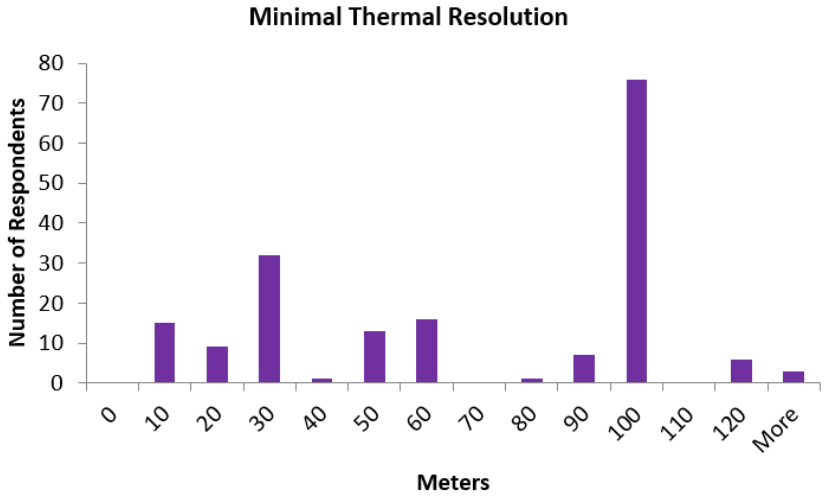


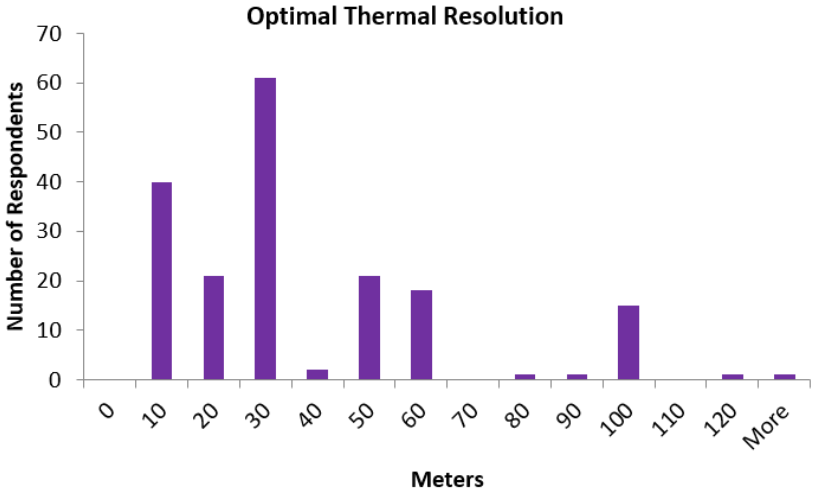
Minimal and Optimal Requirements: Multispectral Spatial Resolution



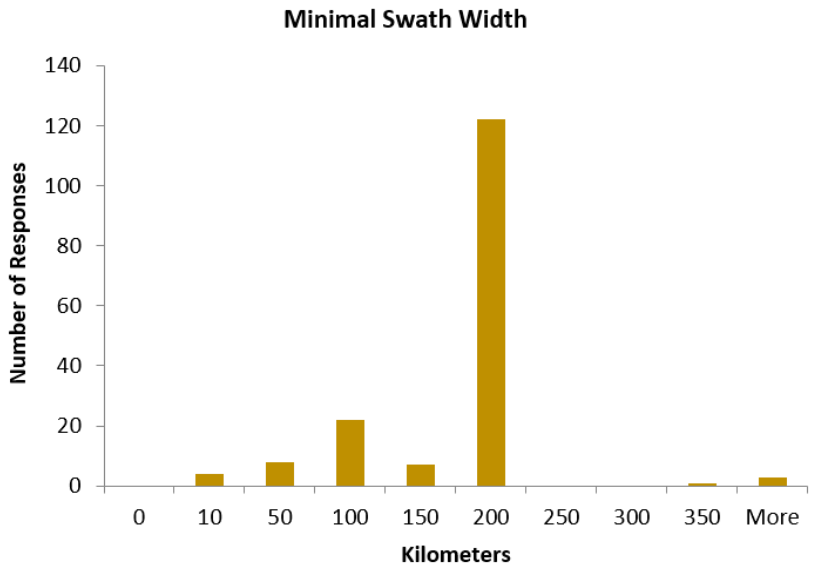


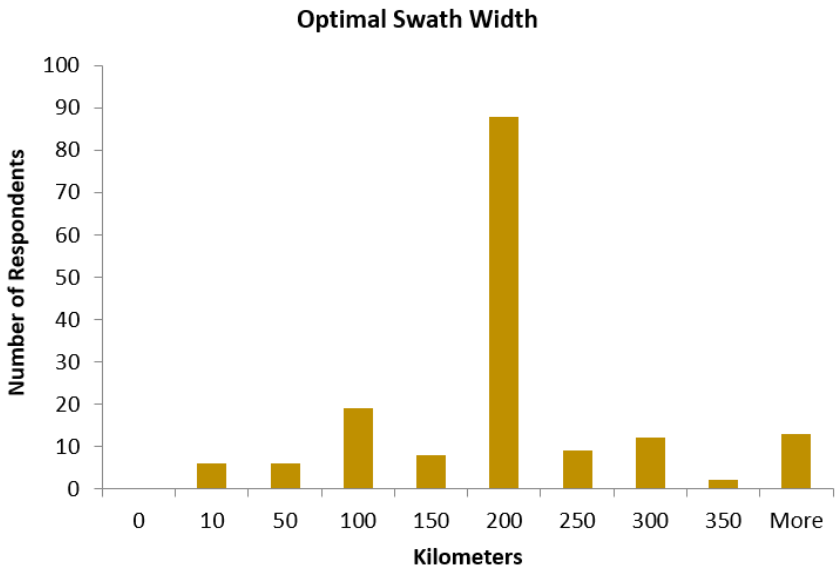
Minimal and Optimal Requirements: Thermal Spatial Resolution



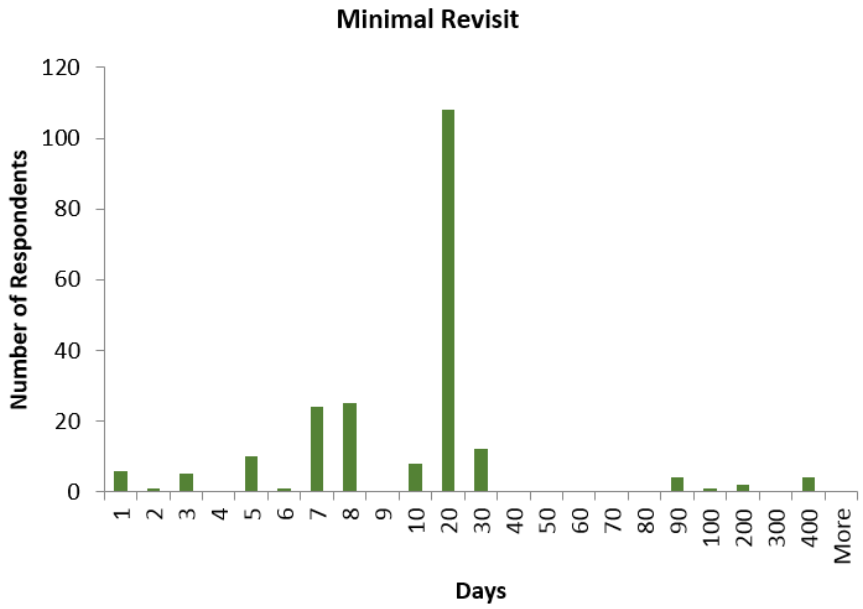


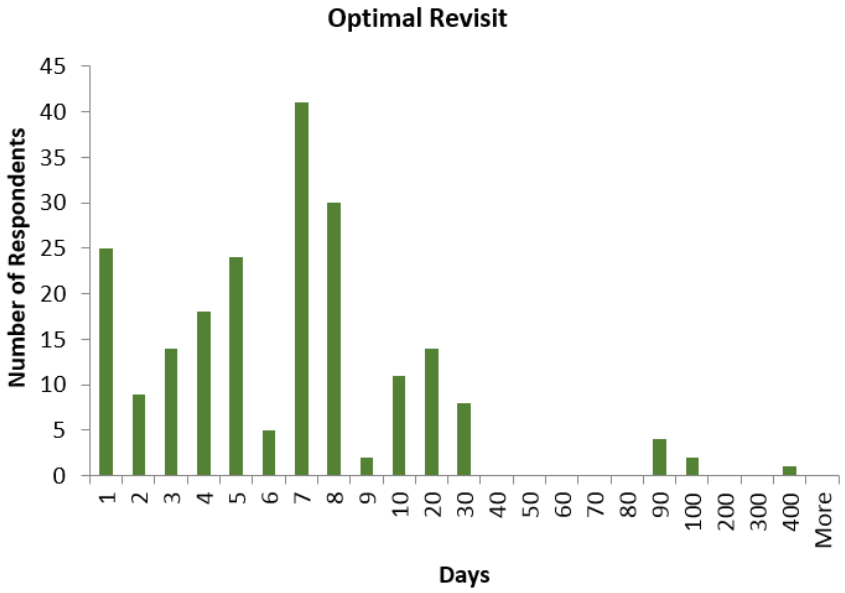
Minimal and Optimal Requirements: Swath Width





Minimal and Optimal Requirements: Revisit





Non-Federal Landsat Requirements Report Major Findings

- The largest population of respondents to the survey were from the academic sector, which is possibly tied to the heavy academic focus of many of the survey outreach efforts. However, all other user groups were well represented in the survey with multiple respondents from the state and local governments, non-governmental organization and international sectors.
- The uses of Landsat imagery by non-federal users continues to be broad and rich. While the largest use is for land cover and land use change analysis, other uses range from agricultural mapping to public health modeling to carbon monitoring.
- Even though the current Landsat optical spatial resolution and revisit period were considered the most important characteristics of Landsat imagery, 65% of the survey respondents believe that revisit time should be reduced and spatial resolution should be increased in future Landsat systems.
- Improved temporal resolution was by far the most named improvement. Thirty-eight percent of the respondents do not believe that the current Landsat temporal resolution meets their minimal requirements, and 86% believe that a revisit time of less than ten days would be optimal.

B. Sentinel and Small Sat Report

- Re new commercial smallsats and microsats
  - *"It was determined the current industry status was insufficiently mature to make any meaningful assessment at the time".*

Sentinel and Small Sat Report

- Re Sentinel data –
  - *“Assuring access to Sentinel 2 on terms comparable to those of the Landsat program is critical”.*
  - *Until the Alaska Satellite Facility is operational, new non-Federal users will not have access to the full Sentinel 1 archive.*
  - *“It is imperative that the US S2 Data Hub become operational as soon as possible.”*

Sentinel and Small Sat Report

- Re Sentinel data –
  - *“ The Study Team is concerned about the informality of the current S2 collection plan and urges USGS to find a more strategic and tactical approach…Possible commitments between USGS and ESA could include incentivizing ESA as well as establishing a US ground station for direct downlink.*
  - “*It is the LAG Q2 Study Team’s assessment that the terms of the current Sentinel Data License are sufficiently open as to be comparable with the USGS Landsat data license.”*

IV. 2016 Task 1 - Revisit of the small sat investigation from the FY15 NGAC study

From the 2015 NGAC paper," the LAG recommended "it was determined the current industry status was insufficiently mature to make any meaningful assessment at this time…

IV. 2016 Task 1 - Revisit of the small sat investigation from the FY15 NGAC study

On the subject of small sats… USGS is requesting that the LAG formulate a comprehensive narrative on the pros and cons of *existing* small sat technology juxtaposed with Landsat 8 and Landsat 9 capabilities…in regards to capabilities related to:

- Spectral collection capabilities and user needs, e.g., visible and near-IR, versus shortwave and thermal IR wavelengths.
- Radiometric and geometric calibration needs to support robust change analysis from a continuity of collection over time.
- Collection tradeoffs among swath width, spatial resolution, and area coverage.

- Support to different mission needs, e.g., situational awareness versus science driven; tactical versus strategic monitoring; spatial and temporal scales of the process being monitored; etc.
- For purposes of this study, the term “small sat” implies miniaturized satellite designs driven mainly by rationales of cost, agility, resilience, and revisit rates.
- Broader study questions to consider include:
- How does the leveraging of small sat technologies and products, as they sufficiently mature to address operational and scientific needs, satisfy interests of the civil user community?
- How can maintaining a broad portfolio of capabilities reduce the risk to meeting current operational needs?
- How could efficient synergy be realized among government and commercial roles for small sat development and operation across broad community needs?

IV. 2016 Task 2 - The feasibility and utility of implementing temporal data cubes to support projection or 'forecast' models of land change trends.

...as a follow on to the LAG study papers on "Product Improvement" and "Cloud computing" published in 2013…it remains unclear whether a deeper market demand for forecasting land change will develop. To that end, the following questions are posed for further study:

- In addition to Landsat, what other data sources (to include EO, SAR, and LIDAR) are optimally suited for leveraging (e.g., co-registered) to support data cube implementations for land change analysis and forecast modeling?
- Which organizations with expertise in forecast modeling are best postured to evaluate and demonstrate the forecast potential from a Landsat-based temporal data cube?

IV. 2016 Task 2 - The feasibility and utility of implementing temporal data cubes to support projection or 'forecast' models of land change trends.

- What is the potential market demand for a land change forecasting capability, e.g., which market sectors, to include those with national security interests, would stand to benefit the most?
- How far back in time into the Landsat archive should the staging of 'analysis ready data' be considered? E.g., early data collections such as multi-spectral scanner (MSS) data are less equipped (in terms of metadata) to support rigorous geometric and radiometric calibration compared to later collections.
- How could efficient synergy be realized among government and commercial roles for data cube development, and operations (processing, storage, distribution) to satisfy broad community needs?

IV. 2016 Task 3 - Data continuity mission enhancements

- A working premise of the data continuity mission is that future collection sensor specifications maintain a level of 'backward compatibility' with past missions to facilitate time-series analysis over the entire record. For this reason, Landsat sensor specifications have evolved deliberately over time. However, the impact to the data continuity mission from 'significant' sensor design enhancements, e.g., spectral and/or spatial resolution, needs to be better understood. This issue applies to future Landsat mission design, as well as integrating continuity data from third party sensors.
- The following question is proposed for potential LAG investigation: To what extent could 'significant' sensor enhancements be made in future Landsat missions, while maintaining acceptable backward compatibility? What would be the suggested methods for data aggregation and validation?